



ENVIRONMENTAL PROTECTION AGENCY

6560-50-P

40 CFR Part 82

[EPA-HQ-OAR-2003-0118; FRL-9930-55-OAR]

RIN 2060-AG12

Protection of Stratospheric Ozone: Determination 30 for Significant New Alternatives Policy Program

AGENCY: Environmental Protection Agency (EPA).

ACTION: Determination of acceptability.

SUMMARY: This determination of acceptability expands the list of acceptable substitutes pursuant to the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program. This action lists as acceptable additional substitutes for use in the refrigeration and air conditioning; foam blowing; solvent cleaning; aerosols; and adhesives, coatings, and inks sectors.

DATES: This determination is effective on **[Insert date of publication in the Federal Register]**.

ADDRESSES: EPA established a docket for this action under Docket ID No. EPA-HQ-OAR-2003-0118 (continuation of Air Docket A-91-42). All electronic documents in the docket are listed in the index at www.regulations.gov. Although listed in the index, some information is not publicly available, i.e., Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Publicly available docket

materials are available either electronically at www.regulations.gov or in hard copy at the EPA Air Docket (Nos. A-91-42 and EPA-HQ-OAR-2003-0118), EPA Docket Center (EPA/DC), William J. Clinton West, Room 3334, 1301 Constitution Avenue, NW, Washington, DC 20460. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air Docket is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Gerald Wozniak by telephone at (202) 343-9624, by e-mail at wozniak.gerald@epa.gov, or by mail at U.S. Environmental Protection Agency, Mail Code 6205T, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Overnight or courier deliveries should be sent to the office location at 1201 Constitution Avenue, NW, Washington, DC 20004.

For more information on the Agency's process for administering the SNAP program or criteria for the evaluation of substitutes, refer to the original SNAP rulemaking published in the Federal Register on March 18, 1994 (59 FR 13,044). Notices and rulemakings under the SNAP program, as well as other EPA publications on protection of stratospheric ozone, are available at EPA's Ozone Depletion website at www.epa.gov/ozone/strathome.html including the SNAP portion at www.epa.gov/ozone/snap/.

SUPPLEMENTARY INFORMATION:

- I. Listing of New Acceptable Substitutes
 - A. Refrigeration and Air Conditioning

- B. Foam Blowing
 - C. Solvent Cleaning
 - D. Aerosols
 - E. Adhesives, Coatings, and Inks
- II. Section 612 Program
- A. Statutory Requirements and Authority for the SNAP Program
 - B. EPA's Regulations Implementing Section 612
 - C. How the Regulations for the SNAP Program Work
 - D. Additional Information about the SNAP Program
- Appendix A: Summary of Decisions for New Acceptable Substitutes

I. Listing of New Acceptable Substitutes

This action presents EPA's most recent decision to list as acceptable several substitutes in the refrigeration and air conditioning; foam blowing; solvent cleaning; aerosols; and adhesives, coatings, and inks sectors. New substitutes are:

- R-450A in new vending machines;
- R-448A in several refrigeration and air conditioning end-uses;
- R-513A in several refrigeration and air conditioning end-uses;
- R-449A in several refrigeration and air conditioning end-uses;
- Hydrofluoroolefin¹ (HFO)-1336mzz(Z) in rigid polyurethane spray foam (high-pressure, two-part uses only); and

¹ Hydrofluoroolefins are unsaturated hydrofluorocarbons having at least one double bond.

- Methoxytridecafluoroheptene isomers (MPHE) in non-mechanical heat transfer, three solvent cleaning end-uses, aerosol solvents, and adhesives and coatings.

For copies of the full list of acceptable substitutes for ozone depleting substances (ODS) in all industrial sectors, visit EPA's Ozone Layer Protection website at www.epa.gov/ozone/snap/lists/index.html. Substitutes listed as unacceptable; acceptable, subject to narrowed use limits; or acceptable, subject to use conditions are also listed in the appendices to 40 CFR part 82, subpart G.

The sections below discuss each substitute listing in detail. Appendix A contains tables summarizing today's listing decisions for these new substitutes. The statements in the "Further Information" column in the tables provide additional information, but are not legally binding under section 612 of the Clean Air Act (CAA). In addition, the "Further Information" column may not include a comprehensive list of other legal obligations you may need to meet when using the substitute. Although you are not required to follow recommendations in the "Further Information" column of the table to use a substitute consistent with section 612 of the CAA, some of these statements may refer to obligations that are enforceable or binding under federal or state programs other than the SNAP program. In many instances, the information simply refers to standard operating practices in existing industry standards and/or building codes. When using these substitutes, EPA strongly encourages you to apply the information in this column. Many of these recommendations, if adopted, would not require significant changes to existing operating practices.

You can find submissions to EPA for the substitutes listed in this document, as well as other materials supporting the decisions in this action, in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov.

A. Refrigeration and Air Conditioning

1. R-450A

EPA's decision: EPA finds R-450A acceptable as a substitute for use in new equipment in vending machines.

R-450A, marketed under the trade name Solstice® N-13, is a weighted blend of 42 percent hydrofluorocarbon (HFC)-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and 58 percent HFO-1234ze(E), which is also known as *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Solstice® N-13 (R-450A) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following name:

- “Risk Screen on Substitutes for Use in Retail Food Refrigeration, Vending Machines, and Commercial Ice Machines Substitute: R-450A”

EPA previously listed R-450A as acceptable for use as a refrigerant in several refrigeration and air conditioning end-uses (October 21, 2014, 79 FR 62,863).

Environmental information: R-450A has an ozone depletion potential (ODP) of zero. Its components, HFC-134a and HFO-1234ze(E), have global warming potentials

(GWPs) of 1,430² and one to six,³ respectively. When these values are weighted by mass percentage, then R-450A has a 100-year integrated GWP (100-yr GWP) of about 600. The components of R-450A are both excluded from the definition of volatile organic compounds (VOC) under CAA regulations (see 40 CFR 51.100(s)) addressing the development of state implementation plans (SIPs) to attain and maintain the national ambient air quality standards (NAAQS). Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).⁴

Flammability information: R-450A as formulated and in the worst-case fractionation formulation is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

² Unless otherwise stated, all GWPs in this document are from: IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K. B., Tignor M., and Miller, H. L. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. This document is accessible at www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html.

³ Hodnebrog, Ø., Etminan, M., Fuglestad, J. S., Marston, G., Myhre, G., Nielsen, C. J., Shine, K. P., Wallington, T. J., Global Warming Potentials and Radiative Efficiencies of Halocarbons and Related Compounds: A Comprehensive Review, *Reviews of Geophysics*, 51, 300-378, doi:10.1002/rog.20013, 2013.; Javadi, M. S., Søndergaard, R., Nielsen, O. J., Hurley, M. D., and Wallington, T. J.: Atmospheric chemistry of trans-CF₃CH=CHF: products and mechanisms of hydroxyl radical and chlorine atom initiated oxidation. *Atmospheric Chemistry and Physics*, 8, 3141-3147, 2008.

⁴ For more information, including definitions, see 40 CFR part 82 subpart F.

The American Industrial Hygiene Association (AIHA) has established Workplace Environmental Exposure Levels (WEELs) of 1,000 ppm and 800 ppm as 8-hour time-weighted averages (TWAs) for HFC-134a and HFO-1234ze(E), the components of R-450A, respectively. The manufacturer of R-450A recommends an acceptable exposure limit (AEL) for the workplace of 880 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL, and address potential health risks by following requirements and recommendations in the manufacturer's safety data sheet (SDS), in the American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-450A has an ODP of zero, comparable⁵ to or lower than other listed substitutes. R-450A's GWP of about 600 is higher than that of some acceptable substitutes in this end-use, such as CO₂ with a GWP of one and propane (R-290), isobutane (R-600a), and R-441A with GWPs ranging from three to eight; is comparable to IKON-B's GWP of approximately 550; and is lower than FRIGC FR-12's GWP of approximately 1,080.⁶ Flammability risks are low, as discussed above, and are comparable to flammability risks of other available substitutes in the same end-use. The toxicity risks are similar to those for many other refrigerants and, as with those other refrigerants, can be minimized by use consistent with the AIHA WEELs,

⁵ This is in contrast to the historically used ODS hydrochlorofluorocarbon (HCFC)-22 with an ODP of 0.055.

⁶ Propane (R-290), isobutane (R-600a), and R-441A are acceptable, subject to use conditions, in this end-use. These three substitutes are subject to a use condition restricting charge sizes to 150 grams (g) or less and thus may limit their use for equipment that requires larger charge sizes.

ASHRAE 15 and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry; moreover, these risks are common to many refrigerants, including many of those already listed as acceptable under SNAP.

EPA finds R-450A acceptable in the end-use listed above, because the overall environmental and human health risk posed by R-450A is lower than or comparable to the risks posed by other substitutes acceptable in the same end-use.

2. R-448A

EPA's decision: EPA finds R-448A acceptable as a substitute for use in:

- Commercial ice machines (new and retrofit equipment)
- Refrigerated transport (new and retrofit equipment)
- Retail food refrigeration—low-temperature stand-alone equipment (i.e., equipment designed to maintain internal temperatures at 32°F (0°C) or below) (new and retrofit equipment)
- Retail food refrigeration—supermarket systems and remote condensing units (new and retrofit equipment)

R-448A, marketed under the trade name Solstice® N-40, is a weighted blend of 26 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 26 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 21 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); 20 percent HFO-1234yf, which is also known as 2,3,3,3-

tetrafluoroprop-1-ene (CAS Reg. No 754-12-1); and 7 percent HFO-1234ze(E), which is also known as *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Solstice® N-40 (R-448A) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following names:

- “Risk Screen on Substitutes for Use in Retail Food Refrigeration and Commercial Ice Machines Substitute: R-448A”
- “Risk Screen on Substitutes for Use in Refrigerated Transport Substitute: R-448A”

Environmental information: R-448A has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, HFO-1234yf, and HFO-1234ze(E) have GWPs of 675; 3,500; 1,430; one to four;^{7,8} and one to six;⁹ respectively. If these values are weighted by mass percentage, then R-448A has a GWP of about 1,390. The components of R-448A are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

⁷ Hodnebrog *et al.*, 2013. *Op. cit.*

⁸ Nielsen, O. J., Javadi, M. S., Sulbaek Andersen, M. P., Hurley, M. D., Wallington, T. J., Singh, R. Atmospheric chemistry of CF₃CF=CH₂: Kinetics and mechanisms of gas-phase reactions with Cl atoms, OH radicals, and O₃. *Chemical Physics Letters* 439, 18-22, 2007.

⁹ Hodnebrog *et al.*, 2013 and Javadi *et al.*, 2008. *Op. cit.*

Flammability information: R-448A as formulated and in the worst-case fractionation formulation is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E), the components of R-448A. The manufacturer of R-448A recommends an AEL of 890 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet the AIHA WEELs and manufacturer's AEL, and address potential health risks by following requirements and recommendations in the SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-448A has an ODP of zero, comparable¹⁰ to or lower than the other substitutes acceptable in these end-uses.

In refrigerated transport, many substitutes listed as acceptable have comparable or higher GWPs, such as HFC-134a, R-404A, and other HFC refrigerant blends, with GWPs ranging from 1,430 to approximately 3,990; other substitutes listed as acceptable substitutes for refrigerated transport have a lower GWP including R-450A, CO₂, direct nitrogen expansion, and Stirling cycle, with GWPs ranging from zero to about 600.

¹⁰ This is in contrast to the historically used ODS chlorofluorocarbon (CFC)-12, R-502A, and HCFC-22 with ODPs ranging from 0.055 to 1.0.

For commercial ice machines, many substitutes listed as acceptable have comparable or higher GWPs, such as HFC-134a, R-404A, and other HFC blends with GWPs ranging from approximately 1,400 to 3,990; other substitutes listed as acceptable substitutes for commercial ice machines have a lower GWP including ammonia absorption, ammonia vapor compression, Stirling cycle, and R-450A with GWPs ranging from zero to about 600.

R-448A's GWP of about 1,390 is comparable to or lower than a number of other substitutes listed as acceptable in retail food refrigeration—supermarket systems and remote condensing units, including three of the more commonly used substitutes at this time: HFC-134a, R-407A, and R-407C, with GWPs ranging from 1,430 to approximately 2,110. R-448A's GWP of about 1,390 is higher than the GWP of some other acceptable substitutes in retail food refrigeration—supermarket refrigeration systems and remote condensing units, including CO₂ with a GWP of one and R-450A with a GWP of about 600.

R-448A's GWP of about 1,390 is comparable to the GWP of several refrigerants listed as acceptable for the retail food refrigeration-low-temperature stand-alone equipment end-use: HFC-134a with a GWP of 1430 and a number of HFC blends with GWPs in the range of 1,100 to 1,500.¹¹ The GWP of R-448A is higher than that of some

¹¹ Historically, under the SNAP listings, we have not subdivided the retail food refrigeration—stand-alone equipment end-use. In the final rule that changes the status of certain refrigerants for this end-use and which we are issuing contemporaneously with this action, we have determined that the refrigerant choices for low-temperature stand-alone equipment, for which greater cooling capacity is required, are more limited than for other stand-alone equipment (which we refer to as medium-temperature equipment). In that action, we subdivided the stand-alone equipment end-use. Therefore, in this action we are evaluating low-temperature equipment and medium-temperature equipment as separate end-uses.

other listed substitutes for the low-temperature stand-alone equipment end-use, including CO₂, propane, isobutane, and R-441A (with GWPs ranging from one to eight).

Flammability risks are low, as discussed above, and are comparable to flammability risks of other available substitutes in the same end-uses. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15, and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry; moreover, those risks are common to many refrigerants, including many of those already listed as acceptable under SNAP for these same end-uses.

EPA finds R-448A acceptable in the end-uses listed above, because the overall environmental and human health risk posed by R-448A is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

3. R-513A

EPA's decision: EPA finds R-513A acceptable as a substitute for use in:

- Centrifugal chillers (new and retrofit equipment)
- Cold storage warehouses (new and retrofit equipment)
- Commercial ice machines (new and retrofit equipment)
- Household refrigerators and freezers (new and retrofit equipment)
- Industrial process air-conditioning (new and retrofit equipment)
- Industrial process refrigeration (new and retrofit equipment)
- Reciprocating, screw and scroll chillers (new and retrofit equipment)
- Refrigerated transport (new and retrofit equipment)

- Retail food refrigeration—low-temperature and medium-temperature¹² stand-alone equipment (new and retrofit equipment)
- Retail food refrigeration—supermarket systems and remote condensing units (new and retrofit equipment)
- Vending machines (new and retrofit equipment)
- Water coolers (new and retrofit equipment)

R-513A, marketed under the trade name Opteon® XP 10, is a weighted blend of 44 percent HFC-134a, which is also known as 1,1,1,2 tetrafluoroethane (CAS Reg. No. 811-97-2); and 56 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Opteon® XP 10 (R-513A) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following names:

- “Risk Screen on Substitutes for Use in Chillers and Industrial Process Air Conditioning Substitute: R-513A”
- “Risk Screen on Substitutes for Use in Cold Storage Warehouses and Industrial Process Refrigeration Substitute: R-513A”

¹² As provided in the listing decision for R-448A for retail food refrigeration, we are making separate listing decisions for low-temperature stand-alone equipment (i.e. equipment designed to maintain internal temperatures at 32°F (0°C) or below) and medium-temperature equipment (i.e., stand-alone equipment designed to maintain internal temperatures above 32°F (0°C)).

- “Risk Screen on Substitutes for Use in Household Refrigerators and Freezers and Water Coolers Substitute: R-513A”
- “Risk Screen on Substitutes for Use in Refrigerated Transport Substitute: R-513A”
- “Risk Screen on Substitutes for Use in Retail Food Refrigeration, Vending Machines, and Commercial Ice Machines Substitute: R-513A”

Environmental information: R-513A has an ODP of zero. Its components, HFC-134a and HFO-1234yf, have GWPs of 1,430 and one to four,¹³ respectively. If these values are weighted by mass percentage, then R-513A has a GWP of about 630. The components of R-513A are both excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-513A as formulated and in the worst-case fractionation formulation is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

¹³ Hodnebrog *et al.*, 2013 and Nielsen *et al.*, 2007. *Op. cit.*

The AIHA has established WEELs of 1,000 ppm and 500 ppm as an 8-hour TWA for HFC-134a and HFO-1234yf, respectively, the components of R-513A. The manufacturer of R-513A recommends an AEL of 653 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL, and address potential health risks by following requirements and recommendations in the SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-513A has an ODP of zero, comparable¹⁴ to or lower than other listed substitutes in these end-uses.

R-513A's GWP of about 630 is comparable to or lower than a number of other substitutes in retail food refrigeration—supermarket systems and remote condensing units, including R-450A, HFC-134a, R-407A, R-407C, and a number of HFC blends, with GWPs ranging from approximately 600 to 2,110. R-513's GWP of about 630 is higher than those of some other acceptable substitutes in new retail food refrigeration—supermarket refrigeration systems and remote condensing units, including CO₂ with a GWP of one.

In retail food refrigeration—low-temperature stand-alone equipment, R-513A's GWP of about 630 is comparable to or lower than a number of other substitutes, including IKON B, R-450A, FRIGC FR-12, HFC-134a, and R-426A with GWPs ranging from approximately 550 to approximately 1,500. In retail food-refrigeration—medium temperature stand-alone equipment and vending machines, R-513A's GWP of about 630

¹⁴ This is in contrast to the historically used ODS CFC-12, R-502A, and HCFC-22 with ODPs ranging from 0.055 to 1.0.

is higher than that of some acceptable substitutes in this end-use, such as CO₂ with a GWP of one and propane (R-290), isobutane (R-600a), and R-441A with GWPs ranging from three to eight; is comparable to the GWPs of IKON-B and R-450A, which are approximately 550 to 600; and is lower than FRIGC FR-12's GWP of approximately 1,080.¹⁵

In refrigerated transport, many substitutes listed as acceptable have comparable or higher GWPs, such as R-450A, HFC-134a, R-404A, and other HFC refrigerant blends, with GWPs ranging from approximately 600 to approximately 3,990; acceptable substitutes for refrigerated transport with a lower GWP include CO₂, direct nitrogen expansion, and Stirling cycle, with GWPs in the range of zero to one.

For cold storage warehouses and industrial process refrigeration, many substitutes listed as acceptable have comparable or higher GWPs, such as R-450A, HFC-134a, R-404A, and other HFC refrigerant blends, with GWPs ranging from approximately 600 to approximately 3,990; acceptable substitutes for new cold storage warehouses and for industrial process refrigeration with a lower GWP include CO₂ and ammonia with GWPs in the range of zero to one.

For commercial ice machines, most other substitutes listed as acceptable have comparable or higher GWPs, such as R-450A, R-404A and other HFC blends with GWPs ranging from approximately 600 to 3,990. Ammonia vapor compression with a GWP of zero is also an acceptable substitute in this end-use.

¹⁵ Propane (R-290), isobutane (R-600a), and R-441A are acceptable, subject to use conditions, in this end-use. These three substitutes are subject to a use condition restricting charge sizes to 150 g or less and thus may limit their use for equipment that requires larger charge sizes.

In household refrigerators and freezers, many substitutes listed as acceptable have comparable or higher GWPs than R-513A, such as R-450A, R-134a, R-404A and other HFC blends with GWPs ranging from approximately 600 to 3,990. R-513A's GWP of approximately 630 is higher than those of some other acceptable substitutes in this end-use for new equipment, including propane, isobutane, and R-441A¹⁶ (with GWPs ranging from three to eight), and HFC-152a with a GWP of 124.

For centrifugal, reciprocating, screw and scroll chillers, most other substitutes listed as acceptable have comparable or higher GWPs, such as R-450A, R-134a, R-404A and other HFC blends with GWPs ranging from approximately 600 to 3,990. In these end-uses, acceptable substitutes with lower GWPs for new equipment include ammonia absorption and ammonia vapor compression, HFO-1234ze(E), and for centrifugal chillers only, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, with GWPs in the range of zero to seven.

For industrial process air conditioning and water coolers, all other substitutes listed as acceptable have comparable or higher GWPs, such as R-450A, R-134a, R-404A and other HFC blends with GWPs ranging from approximately 600 to 3,990.

Flammability risks are low, as discussed above, and are comparable to flammability risks of other available substitutes in the same end-uses. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry; moreover, those risks are common to many

¹⁶ Propane (R-290), isobutane (R-600a), and R-441A are acceptable, subject to use conditions, in this end-use. These three substitutes are subject to a use condition restricting charge sizes to 57 g or less and thus may limit their use for equipment that requires larger charge sizes.

refrigerants, including many of those already listed as acceptable under SNAP for these same end-uses.

EPA finds R-513A acceptable in the end-uses listed above, because the overall environmental and human health risk posed by R-513A is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

4. R-449A

EPA's decision: EPA finds R-449A acceptable as a substitute for use in:

- Commercial ice machines (new and retrofit equipment)
- Refrigerated transport (new and retrofit equipment)
- Retail food refrigeration—low-temperature stand-alone equipment (new and retrofit equipment)
- Retail food refrigeration—supermarket systems and remote condensing units (new and retrofit equipment)

R-449A, marketed under the trade name Opteon® XP 40, is a weighted blend of 24.3 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 24.7 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 25.7 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and 25.3 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Opteon® XP 40 (R-449A) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of

this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following names:

- “Risk Screen on Substitutes for Use in Refrigerated Transport Substitute: R-449A”
- “Risk Screen on Substitutes for Use in Retail Food Refrigeration and Commercial Ice Machines Substitute: R-449A”

Environmental information: R-449A has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, and HFO-1234yf have GWPs of 675; 3,500; 1,430; and one to four,¹⁷ respectively. If these values are weighted by mass percentage, then R-449A has a GWP of about 1,400. The components of R-449A are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-449A as formulated and in the worst-case fractionation formulation is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

¹⁷ Hodnebrog *et al.*, 2013 and Nielsen *et al.*, 2007. *Op. cit.*

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf, the components of R-449A. The manufacturer of R-449A recommends an AEL of 830 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-449A has an ODP of zero, comparable¹⁸ to or lower than the other substitutes acceptable in these end-uses.

In refrigerated transport, many substitutes listed as acceptable have comparable or higher GWPs than R-449's GWP of about 1,400, such as HFC-134a, R-404A, and other HFC refrigerant blends, with GWPs ranging from 1,430 to approximately 3,990; other substitutes listed as acceptable substitutes for refrigerated transport have a lower GWP including R-450A, CO₂, direct nitrogen expansion, and Stirling cycle, with GWPs ranging from zero to about 600.

For commercial ice machines, many substitutes listed as acceptable have comparable or higher GWPs than R-449's GWP of about 1,400, such as HFC-134a, R-404A and other HFC blends with GWPs ranging from approximately 1,400 to 3,990; other substitutes listed as acceptable substitutes for commercial ice machines have a lower GWP including ammonia absorption, ammonia vapor compression, Stirling cycle and R-450A, with GWPs ranging from zero to about 600.

¹⁸ This is in contrast to the historically used ODS CFC-12, R-502A, and HCFC-22 with ODPs ranging from 0.055 to 1.0.

R-449A's GWP of about 1,400 is comparable to or lower than a number of other substitutes listed as acceptable in retail food refrigeration—supermarket systems and remote condensing units, including three of the more commonly used substitutes at this time: HFC-134a, R-407A, and R-407C, with GWPs ranging from 1,430 to approximately 2,110. R-449A's GWP of about 1,400 is higher than the GWP of some other acceptable substitutes in retail food refrigeration—supermarket refrigeration systems and remote condensing units, including CO₂ with a GWP of one and R-450A with a GWP of about 600.

R-449A's GWP of about 1,400 is comparable to the GWP of substitutes listed as acceptable for retail food refrigeration—low-temperature stand-alone equipment, including HFC-134a of 1,430 and a number of HFC blends with GWPs in the range of 1,100 to 1,500 and is higher than those of some other listed substitutes in this end-use, including CO₂ with a GWP of one and propane, isobutane, and R-441A (with GWPs ranging from three to eight).¹⁹

Flammability risks are low, as discussed above, and are comparable to flammability risks of other available substitutes in the same end-uses. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry; moreover, those risks are common to many refrigerants, including many of those already listed as acceptable under SNAP in these same end-uses.

¹⁹ Propane (R-290), isobutane (R-600a), and R-441A are acceptable, subject to use conditions, in this end-use. These three substitutes are subject to a use condition restricting charge sizes to 150 g or less and thus may limit their use for equipment that requires larger charge sizes.

EPA finds R-449A acceptable in the end-uses listed above, because the overall environmental and human health risk posed by R-449A is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

5. Methoxytridecafluoroheptene isomers (MPHE)

*EPA's decision: EPA finds methoxytridecafluoroheptene isomers acceptable as a substitute for use in new and retrofit equipment in non-mechanical heat transfer.*²⁰

MPHE, marketed under the trade name Sinera™, is a HFO. It is a mixture of structural and stereo isomers, represented as C₇F₁₃(OCH₃). *Trans*-5-methoxy-perfluoro-3-heptene is the most prevalent isomer in the mixture (approximately 50 percent), and eight isomeric structures have been identified, comprising more than 99% of the material.

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "SNAP Information Notice for Methoxytridecafluoroheptene isomers (MPHE) Received July 2, 2012." EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 under the following name, "Risk Screen on Substitutes in Non-mechanical Heat Transfer Substitute: Methoxytridecafluoroheptene isomers."

Environmental information: MPHE has an ODP of zero. The 100-yr GWP of MPHE is 2.5 and it has an atmospheric lifetime of approximately nine days. MPHE is regulated as a VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing

²⁰ Acceptable substitutes for organic Rankine cycle have typically been included through listings in the non-mechanical heat transfer end-use. EPA may review organic Rankine cycle applications separately in the future.

this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: MPHE is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include serious eye irritation, skin irritation, and respiratory tract irritation. Ingestion of MPHE may also be harmful. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

EPA anticipates that MPHE will be used in a manner consistent with the recommendations specified in the SDS. The manufacturer recommends an AEL of 500 ppm on an 8-hour TWA. EPA anticipates that users will be able to meet the AEL and address potential health risks by following requirements and recommendations in the SDS and in any other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: MPHE has an ODP of zero, comparable²¹ to or lower than other acceptable substitutes in this same end-use. Additionally, MPHE's GWP of 2.5 is lower than or comparable to the GWP of other acceptable substitutes in the same end-use, such as C7 Fluoroketone, HFO-1234ze(E), HFC-245fa, and HFC-125 (with GWPs ranging from about one to 3,500). Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the manufacturer's AEL, recommendations in the SDS, and other safety precautions

²¹ In contrast, the historically used ODS HCFC-123, HCFC-22, and CFC-113 have ODPs ranging from 0.01 to 0.8.

common in the refrigeration and air conditioning industry; moreover, those risks are common to many heat transfer fluids, including many of those already listed as acceptable under SNAP.

EPA finds MPHE acceptable in the end-use listed above, because the overall environmental and human health risk posed by MPHE is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-use.

B. Foam Blowing

1. HFO-1336mzz(Z) (Formacel® 1100)

*EPA's decision: EPA finds HFO-1336mzz(Z) acceptable as a substitute for use in rigid polyurethane spray foam (high-pressure, two-part uses only).*²²

HFO-1336mzz(Z) is also known as (Z)-1,1,1,4,4,4-hexafluorobut-2-ene and *cis*-1,1,1,4,4,4-hexafluorobut-2-ene (CAS Reg. No. 692-49-9), and goes by the trade names of FEA-1100 and Formacel® 1100.

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “SNAP Information Notice for FEA-1100 as a Foam Blowing Agent Received 8/3/11.” EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name, “Risk Screen on Substitutes for Spray Foam Substitute: HFO-1336mzz(Z) (Formacel® 1100).”

²² Historically, under the SNAP listings, we have not subdivided the rigid polyurethane (PU) spray foam end-use. In the final rule that we are issuing contemporaneously with this action, we have determined that the foam blowing agent choices differ for rigid PU high-pressure two-part spray foam, rigid PU low-pressure two-part spray foam, and rigid PU one-component foam sealants. Therefore, in this action we are evaluating high-pressure two-part spray foam as a separate end-use from rigid PU low-pressure two-part spray foam and rigid PU one-component foam sealants.

We have previously listed HFO-1336mzz(Z) as a foam blowing agent in a number of other foam blowing end-uses (October 21, 2014, 79 FR 62,863).

Environmental information: HFO-1336mzz(Z) has an ODP of zero. It has a 100-yr GWP of about nine.²³ HFO-1336mzz(Z) is a VOC. The manufacturer has petitioned EPA to exempt HFO-1336mzz(Z) from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)), which addresses the development of SIPs to attain and maintain the NAAQS, based on its claim that the chemical exhibits low photochemical reactivity.

Flammability information: HFO-1336mzz(Z) is not flammable.

Toxicity and exposure data: Potential health effects of this substitute include skin or eye irritation or frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many foam blowing agents. Additionally, as described in the Premanufacture Notice (PMN), exposure to consumers is expected to be minimal since HFO-1336mzz(Z) is not domestically manufactured or used by consumers. EPA issued a Significant New Use Rule (SNUR) on June 5, 2015, to require persons to submit a Significant New Use Notice (SNUN) to EPA at least 90 days before they manufacture or process HFO-1336mzz(Z) for consumer use (80 FR 32,003, 32,005).

EPA anticipates that HFO-1336mzz(Z) will be used consistent with the recommendations specified in the SDS. The WEEL committee of the Occupational Alliance for Risk Science (OARS) recommends a WEEL for the workplace of 500 ppm

²³ Baasandorj, M., Ravishankara, A. R., Burkholder, J. B., Atmospheric Chemistry of (Z)-CF₃CH=CHCF₃: OH Radical Reaction Rate Coefficient and Global Warming Potential, *Journal of Physical Chemistry A*, 2011, 115, 10,539–10,549, 2011.

on an 8-hour TWA.²⁴ EPA anticipates that users will be able to meet the WEEL and address potential health risks by following requirements and recommendations in the SDS and other safety precautions common to the foam blowing industry.

Comparison to other foam blowing agents: HFO-1336mzz(Z) has an ODP of zero, comparable²⁵ to or lower than other acceptable non-ozone-depleting substitutes for the rigid PU high-pressure, two-part spray foam end-use. HFO-1336mzz(Z)'s GWP of about nine is lower than or comparable to other acceptable substitutes in this end-use, such as HFC-245fa with a GWP of 1,070; commercial blends of HFC-365mfc and HFC-227ea containing 7% to 13% HFC-227ea and the remainder HFC-365mfc, with GWPs ranging from about 900 to 1,100; *trans*-1-chloro-3,3,3-trifluoroprop-1-ene and water, with GWPs of one to seven^{26,27,28} and zero, respectively. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the OARS WEEL, recommendations in the SDS, and other safety precautions common in the foam blowing industry; moreover, those risks are common to many foam blowing agents, including many of those already listed as acceptable under SNAP for this end-use.

²⁴ The documentation may be viewed at www.tera.org/OARS/HFO-1336mzz-Z%20WEEL%20FINAL.pdf.

²⁵ In contrast, the historically used ODS CFC-11 and HCFC-141b have ODPs ranging from 0.1 to 1.0.

²⁶ Wang D., Olsen S., and Wuebbles D. Preliminary Report: Analyses of tCFP's Potential Impact on Atmospheric Ozone. Department of Atmospheric Sciences. University of Illinois, Urbana, IL. September 26, 2011; Hodnebrog et al., 2013. *Op. cit.*

²⁷ Sulbaek Andersen, M. P., Nilsson, E. J. K., Nielsen, O. J., Johnson, M. S., Hurley, M.D., and Wallington, T. J. Atmospheric chemistry of *trans*-CF₃CH=CHCl: Kinetics of the gas-phase reactions with Cl atoms, OH radicals, and O₃, *Journal of Photochemistry and Photobiology A: Chemistry*, 199, 92-97, 2008.

²⁸ Wang D., Olsen S., and Wuebbles D. Three-Dimensional Model Evaluation of the Global Warming Potentials for tCFP. Department of Atmospheric Sciences. University of Illinois, Urbana, IL. Draft report, undated.

EPA finds HFO-1336mzz(Z) acceptable in the end-use listed above, because the overall environmental and human health risk posed by HFO-1336mzz(Z) is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-use.

C. Solvent Cleaning

1. Methoxytridecafluoroheptene isomers (MPHE)

EPA's decision: EPA finds methoxytridecafluoroheptene isomers acceptable as a substitute for use in:

- Electronics cleaning
- Metals cleaning
- Precision cleaning

MPHE, marketed under the trade name Sion™, is an HFO. It is a mixture of structural and stereo isomers, represented as C₇F₁₃(OCH₃). *Trans*-5-methoxy-perfluoro-3-heptene is the most prevalent isomer in the mixture (approximately 50 percent), and eight isomeric structures have been identified, comprising more than 99% of the material.

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "SNAP Information Notice for Methoxytridecafluoroheptene isomers (MPHE) Received July 2, 2012." EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 under the name, "Risk Screen on Substitutes in Metals Cleaning, Electronics Cleaning, and Precision Cleaning Substitute: Methoxytridecafluoroheptene isomers."

Environmental information: The environmental information for this substitute is set forth in the “Environmental information” section in listing A.5.

Flammability information: MPHE is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the “Toxicity and exposure data” section in listing I.A.5. EPA anticipates that users will be able to meet the manufacturer’s AEL of 500 ppm on an 8-hr TWA and address potential health risks by following requirements and recommendations in the SDS and in any other safety precautions common to the solvent cleaning industry.

Comparison to other substitutes in these end-uses: MPHE has an ODP of zero, comparable²⁹ to or lower than the ODP of other substitutes in these three end-uses. MPHE’s GWP of 2.5 is lower than or comparable to those of other acceptable substitutes in these three end-uses, such as acetone, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, *trans*-1,2-dichloroethylene, HFE-7100, and HFC-4310meewith GWPs of 0.5, one to seven,³⁰ less than ten, 297, and 1,640, respectively. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the manufacturer’s AEL, recommendations in the SDS, and other safety precautions common in the solvent cleaning industry; moreover, those risks are common to many solvents, including many of those already listed as acceptable under SNAP for these same end-uses.

²⁹ In contrast, the historically used ODS CFC-113, methyl chloroform, HCFC-225ca, and HCFC-225cb have ODPs ranging from 0.02 to 0.8.

³⁰ Wang *et al.*, 2011; Sulbaek Andersen *et al.*, 2008; and Wang *et al.*, undated; Hodnebrog *et al.*, 2013. *Op cit.*

EPA finds MPHE acceptable in the end-uses listed above, because the overall environmental and human health risk posed by MPHE is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

D. Aerosols

1. Methoxytridecafluoroheptene isomers (MPHE)

EPA's decision: EPA finds methoxytridecafluoroheptene isomers acceptable as a substitute for use as an aerosol solvent.

MPHE is a HFO. It is a mixture of structural and stereo isomers, represented as C₇F₁₃(OCH₃). *Trans*-5-methoxy-perfluoro-3-heptene is the most prevalent isomer in the mixture (approximately 50 percent), and eight isomeric structures have been identified, comprising more than 99% of the material.

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "SNAP Information Notice for Methoxytridecafluoroheptene isomers (MPHE) Received July 2, 2012." EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in Docket EPA-HQ-OAR-2003-0118 under the name, "Risk Screen on Substitutes in Aerosol Solvents Substitute: Methoxytridecafluoroheptene isomers."

Environmental information: The environmental information for this substitute is set forth in the "Environmental information" section in listing I.A.5.

Flammability information: MPHE is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the “Toxicity and exposure data” section in listing I.A.5.

EPA anticipates that users will be able to meet the manufacturer’s AEL of 500 ppm on an 8-hour TWA and address potential health risks by following requirements and recommendations in the SDS and in any other safety precautions common to the aerosol solvent industry.

Comparison to other substitutes in this end-use: MPHE has an ODP of zero, comparable³¹ to or lower than other acceptable substitutes in this end-use. MPHE’s GWP of 2.5 is lower than or comparable to the GWP of other acceptable substitutes in the same end-use, such as acetone, *trans*-1-chloro-3,3,3-trifluoroprop-1-ene, *trans*-1,2-dichloroethylene, HFE-7100, and HFC-4310mee with GWPs of 0.5, one to seven,³² less than ten, 297, and 1,640, respectively. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the manufacturer’s AEL, recommendations in the SDS, and other safety precautions common in the aerosol solvent industry; moreover, those risks are common to many aerosol solvents, including many of those already listed as acceptable under SNAP.

EPA finds MPHE acceptable in the end-uses listed above, because the overall environmental and human health risk posed by MPHE is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

³¹ In contrast, the historically used ODS methyl chloroform, CFC-113, HCFC-141b, HCFC-225ca and HCFC-225cb have ODPs ranging from 0.02 to 0.8.

³² Wang *et al.*, 2011; Sulbaek Andersen *et al.*, 2008; and Wang *et al.*, undated; Hodnebrog *et al.*, 2013. *Op cit.*

E. *Adhesives, Coatings and Inks*

1. Methoxytridecafluoroheptene isomers (MPHE)

EPA's decision: EPA finds methoxytridecafluoroheptene isomers acceptable as a substitute for use as a carrier solvent in:

- Adhesives
- Coatings

MPHE, marketed under the trade name Suprion™, is an HFO. It is a mixture of structural and stereo isomers, represented as C₇F₁₃(OCH₃). *Trans*-5-methoxy-perfluoro-3-heptene is the most prevalent isomer in the mixture (approximately 50 percent), and eight isomeric structures have been identified, comprising more than 99% of the material.

You may find the redacted submission in Docket item EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "SNAP Information Notice for Methoxytridecafluoroheptene isomers (MPHE) Received July 2, 2012." EPA performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name, "Risk Screen on Substitutes in Adhesives and Coatings Substitute: Methoxytridecafluoroheptene isomers."

Environmental information: The environmental information for this substitute is set forth in the "Environmental information" section in listing I.A.5.

Flammability information: MPHE is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the "Toxicity and exposure data" section in listing I.A.5. EPA anticipates that users

will be able to meet the manufacturer's AEL of 500 ppm on an 8-hour TWA and address potential health risks by following requirements and recommendations in the SDS and in any other safety precautions common to the adhesives and coatings industries.

Comparison to other substitutes in these end-uses: MPHE has an ODP of zero, comparable³³ to or lower than other acceptable substitutes in these two end-uses. MPHE's GWP of 2.5 is lower than or comparable to those of other acceptable substitutes in the same end-use, such as acetone, *trans*-1-chloroprop-1-ene, *trans*-1,2-dichloroethylene and HFE-7100 with GWPs of 0.5, one to seven,³⁴ less than ten, and 297, respectively. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the manufacturer's AEL, recommendations in the SDS, and other safety precautions common in the adhesives and coatings industries; moreover, those risks are common to many carrier solvents for adhesives and coatings, including many of those already listed as acceptable under SNAP.

EPA finds MPHE acceptable in the end-uses listed above, because the overall environmental and human health risk posed by MPHE is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

II. Section 612 Program

A. Statutory Requirements and Authority for the SNAP Program

Section 612 of the CAA requires EPA to develop a program for evaluating

³³ In contrast, the historically used ODS methyl chloroform and HCFC-141b have ODPs respectively of 0.1 and 0.11.

³⁴ Wang *et al.*, 2011; Sulbaek Andersen *et al.*, 2008; and Wang *et al.*, undated; Hodnebrog *et al.*, 2013. *Op cit.*

alternatives to ozone-depleting substances. EPA refers to this program as the Significant New Alternatives Policy (SNAP) program. The major provisions of section 612 are:

1. Rulemaking

Section 612(c) requires EPA to promulgate rules making it unlawful to replace any class I substance (CFC, halon, carbon tetrachloride, methyl chloroform, methyl bromide, hydrobromofluorocarbon, and chlorobromomethane) or class II substance (HCFC) with any substitute that the Administrator determines may present adverse effects to human health or the environment where the Administrator has identified an alternative that (1) reduces the overall risk to human health and the environment, and (2) is currently or potentially available.

2. Listing of Unacceptable/Acceptable Substitutes

Section 612(c) requires EPA to publish a list of the substitutes unacceptable for specific uses and to publish a corresponding list of acceptable alternatives for specific uses. The list of “acceptable” substitutes is found at www.epa.gov/ozone/snap/lists and the lists of “unacceptable,” “acceptable subject to use conditions,” and “acceptable subject to narrowed use limits” substitutes are found in the appendices to 40 CFR part 82 subpart G.

3. Petition Process

Section 612(d) grants the right to any person to petition EPA to add a substance to, or delete a substance from, the lists published in accordance with section 612(c). The Agency has 90 days to grant or deny a petition. Where the Agency grants the petition, EPA must publish the revised lists within an additional six months.

4. 90-day Notification

Section 612(e) directs EPA to require any person who produces a chemical substitute for a class I substance to notify the Agency not less than 90 days before new or existing chemicals are introduced into interstate commerce for significant new uses as substitutes for a class I substance. The producer must also provide the Agency with the producer's unpublished health and safety studies on such substitutes.

5. Outreach

Section 612(b)(1) states that the Administrator shall seek to maximize the use of federal research facilities and resources to assist users of class I and II substances in identifying and developing alternatives to the use of such substances in key commercial applications.

6. Clearinghouse

Section 612(b)(4) requires the Agency to set up a public clearinghouse of alternative chemicals, product substitutes, and alternative manufacturing processes that are available for products and manufacturing processes which use class I and II substances.

B. EPA's Regulations Implementing Section 612

On March 18, 1994, EPA published the initial SNAP rule (59 FR 13,044) which established the process for administering the SNAP program and issued EPA's first lists identifying acceptable and unacceptable substitutes in the major industrial use sectors (subpart G of 40 CFR part 82). These sectors are the following: refrigeration and air conditioning; foam blowing; solvents cleaning; fire suppression and explosion protection;

sterilants; aerosols; adhesives, coatings and inks; and tobacco expansion. These sectors comprise the principal industrial sectors that historically consumed the largest volumes of ODS.

Section 612 of the CAA requires EPA to list as acceptable those substitutes that do not present a significantly greater risk to human health and the environment as compared with other substitutes that are currently or potentially available.

C. How the Regulations for the SNAP Program Work

Under the SNAP regulations, anyone who plans to market or produce a substitute to replace a class I substance or class II substance in one of the eight major industrial use sectors must provide the Agency with notice and the required health and safety information on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative (40 CFR 82.176(a)). While this requirement typically applies to chemical manufacturers as the entity likely to be planning to introduce the substitute into interstate commerce,³⁵ it may also apply to importers, formulators, equipment manufacturers, and end-users³⁶ when they are responsible for introducing a substitute into commerce. The 90-day SNAP review process begins once EPA receives the submission and determines that the submission includes complete and adequate data (40 CFR 82.180(a)). The CAA and the SNAP regulations, 40

³⁵ As defined at 40 CFR 82.104, “interstate commerce” means the distribution or transportation of any product between one state, territory, possession or the District of Columbia, and another state, territory, possession or the District of Columbia, or the sale, use or manufacture of any product in more than one state, territory, possession or District of Columbia. The entry points for which a product is introduced into interstate commerce are the release of a product from the facility in which the product was manufactured, the entry into a warehouse from which the domestic manufacturer releases the product for sale or distribution, and at the site of United States Customs clearance.

³⁶ As defined at 40 CFR 82.172, “end-use” means processes or classes of specific applications within major industrial sectors where a substitute is used to replace an ODS.

CFR 82.174(a), prohibit use of a substitute earlier than 90 days after notice has been provided to the agency.

The Agency has identified four possible decision categories for substitute submissions: acceptable; acceptable subject to use conditions; acceptable subject to narrowed use limits; and unacceptable (40 CFR 82.180(b)).³⁷ Use conditions and narrowed use limits are both considered “use restrictions” and are explained below. Substitutes that are deemed acceptable without use conditions may be used for all applications within the relevant end-uses within the sector and without limits under SNAP on how they may be used. Substitutes that are acceptable subject to use restrictions may be used only in accordance with those restrictions. Substitutes that are found to be unacceptable may not be used after the date specified in the rulemaking adding such substitute to the list of unacceptable substitutes.³⁸

After reviewing a substitute, the Agency may make a determination that a substitute is acceptable only if certain conditions in the way that the substitute is used are met to minimize risks to human health and the environment. EPA describes such substitutes as "acceptable subject to use conditions." Entities that use these substitutes without meeting the associated use conditions are in violation of EPA’s SNAP regulations (40 CFR 82.174(c)).

³⁷ The SNAP regulations also include “pending,” referring to submissions for which EPA has not reached a determination, under this provision.

³⁸ As defined at 40 CFR 82.172, “use” means any use of a substitute for a Class I or Class II ozone-depleting compound, including but not limited to use in a manufacturing process or product, in consumption by the end-user, or in intermediate uses, such as formulation or packaging for other subsequent uses. This definition of use encompasses manufacturing process of products both for domestic use and for export. Substitutes manufactured within the United States exclusively for export are subject to SNAP requirements since the definition of use in the rule includes use in the manufacturing process, which occurs within the United States.

For some substitutes, the Agency may permit a narrowed range of use within an end-use or sector. For example, the Agency may limit the use of a substitute to certain end-uses or specific applications within an industry sector. The Agency requires a user of a narrowed use substitute to demonstrate that no other acceptable substitutes are available for their specific application. EPA describes these substitutes as “acceptable subject to narrowed use limits.” A person using a substitute that is acceptable subject to narrowed use limits in applications and end-uses that are not consistent with the narrowed use limit is using the substitute in violation of section 612 of the CAA and EPA’s SNAP regulations (40 CFR 82.174(c)).

The section 612 mandate for EPA to prohibit the use of a substitute that may present risk to human health or the environment where a lower risk alternative is available or potentially available³⁹ provides EPA with the authority to change the listing status of a particular substitute if such a change is justified by new information or changed circumstance.

As described in this document and elsewhere, including the initial SNAP rule published in the Federal Register at 59 FR 13,044 on March 18, 1994, the SNAP program evaluates substitutes within a comparative risk framework. The SNAP program compares new substitutes both to the ozone-depleting substances being phased out under the *Montreal Protocol on Substances that Deplete the Ozone Layer* and the CAA, and to

³⁹ In addition to acceptable commercially available substitutes, the SNAP program may consider potentially available substitutes. The SNAP program’s definition of “potentially available” is “any alternative for which adequate health, safety, and environmental data, as required for the SNAP notification process, exist to make a determination of acceptability, and which the agency reasonably believes to be technically feasible, even if not all testing has yet been completed and the alternative is not yet produced or sold.” (40 CFR 82.172)

other available or potentially available alternatives for the same end-uses. The environmental and health risk factors that the SNAP program considers include ozone depletion potential, flammability, toxicity, occupational and consumer health and safety, as well as contributions to global warming and other environmental factors.

Environmental and human health exposures can vary significantly depending on the particular application of a substitute – and over time, information applicable to a substitute can change. This approach does not imply fundamental tradeoffs with respect to different types of risk, either to the environment or to human health. Over the past twenty years, the menu of substitutes has become much broader and a great deal of new information has been developed on many substitutes. Because the overall goal of the SNAP program is to ensure that substitutes listed as acceptable do not pose significantly greater risk to human health and the environment than other available substitutes, the SNAP criteria should be informed by our current overall understanding of environmental and human health impacts and our experience with and current knowledge about available and potentially available substitutes. Over time, the range of substitutes reviewed by SNAP has changed, and, at the same time, scientific approaches have evolved to more accurately assess the potential environmental and human health impacts of these chemicals and alternative technologies. The Agency publishes its SNAP program decisions in the Federal Register. EPA uses notice-and-comment rulemaking to place any alternative on the list of prohibited substitutes, to list a substitute as acceptable only subject to use conditions or narrowed use limits, or to remove a substitute from either the list of prohibited or acceptable substitutes.

In contrast, EPA publishes “notices of acceptability” or “determinations of acceptability,” to notify the public of substitutes that are deemed acceptable with no restrictions. As described in the preamble to the rule initially implementing the SNAP program (59 FR 13,044; March 18, 1994), EPA does not believe that rulemaking procedures are necessary to list alternatives that are acceptable without restrictions because such listings neither impose any sanction nor prevent anyone from using a substitute.

Many SNAP listings include “comments” or “further information” to provide additional information on substitutes. Since this additional information is not part of the regulatory decision, these statements are not binding for use of the substitute under the SNAP program. However, regulatory requirements so listed are binding under other regulatory programs (e.g., worker protection regulations promulgated by OSHA). The “further information” classification does not necessarily include all other legal obligations pertaining to the use of the substitute. While the items listed are not legally binding under the SNAP program, EPA encourages users of substitutes to apply all statements in the “further information” column in their use of these substitutes. In many instances, the information simply refers to sound operating practices that have already been identified in existing industry and/or building codes or standards. Thus many of the statements, if adopted, would not require the affected user to make significant changes in existing operating practices.

D. Additional Information about the SNAP Program

For copies of the comprehensive SNAP lists of substitutes or additional information on SNAP, refer to EPA's Ozone Depletion website at: www.epa.gov/ozone/snap. For more information on the agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the SNAP final rulemaking published March 18, 1994 (59 FR 13,044), codified at 40 CFR part 82, subpart G. A complete chronology of SNAP decisions and the appropriate citations are found at: www.epa.gov/ozone/snap/chron.html.

List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control, Reporting and recordkeeping requirements.

Date: July 2, 2015.

Sarah Dunham, Director,
Office of Atmospheric Programs.

APPENDIX A: SUMMARY OF DECISIONS FOR NEW ACCEPTABLE SUBSTITUTES

Refrigeration and Air Conditioning

End-Use	Substitute	Decision	Further Information ¹
Vending machines (<i>new equipment</i>).	R-450A (Solstice® N-13)	Acceptable	<p>R-450A has a 100-year global warming potential (GWP) of approximately 600. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234ze(E), which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The American Industrial Hygiene Association (AIHA) has established workplace environmental exposure limits (WEELs) of 1,000 ppm and 800 ppm (8-hr time weighted average (TWA)) for HFC-134a and HFO-1234ze(E), respectively. The manufacturer recommends an acceptable exposure limit (AEL) for the workplace for R-450A of 880 ppm (8-hr TWA).</p> <p>EPA previously listed this refrigerant as acceptable for use in retrofit vending machine equipment.</p>

End-Use	Substitute	Decision	Further Information ¹
Commercial ice machines (<i>new and retrofit equipment</i>).	R-448A (Solstice® N-40)	Acceptable	<p>R-448A has a 100-yr GWP of approximately 1,390. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); HFO-1234yf, which is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS Reg. No. 754-12-1); and HFO-1234ze(E), which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E). The manufacturer recommends an AEL for the workplace for R-448A of 890 ppm (8-hr TWA).</p>
Refrigerated transport (<i>new and retrofit equipment</i>).	R-448A (Solstice® N-40)	Acceptable	<p>R-448A has a 100-yr GWP of approximately 1,390. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2), HFO-1234yf, which is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS Reg. No. 754-12-1); and HFO-1234ze(E), which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E). The manufacturer recommends an AEL for the workplace for R-448A of 890 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Retail food refrigeration (<i>new and retrofit supermarket systems and remote condensing units, and new and retrofit low-temperature³ stand-alone equipment only</i>)	R-448A (Solstice® N-40)	Acceptable	<p>R-448A has a 100-yr GWP of approximately 1,387. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); HFO-1234yf, which is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS Reg. No. 754-12-1); and HFO-1234ze(E), which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E). The manufacturer recommends an AEL for the workplace for R-448A of 890 ppm (8-hr TWA).</p>
Centrifugal chillers (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year global warming potential (GWP) of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Cold storage warehouses (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>
Commercial ice machines (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Household refrigerators and freezers (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>
Industrial process air conditioning (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Industrial process refrigeration (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>
Reciprocating, screw and scroll chillers (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Refrigerated transport (<i>new and retrofit equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>
Retail food refrigeration (<i>new and retrofit supermarket systems and remote condensing units, and new and retrofit low-temperature² and medium-temperature³ stand-alone equipment</i>).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Vending machines (new and retrofit equipment).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>
Water coolers (new and retrofit equipment).	R-513A (Opteon® XP 10)	Acceptable	<p>R-513A has a 100-year GWP of approximately 630. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 500 ppm (8-hr TWA) for HFC-134a and HFO-1234yf, respectively. The manufacturer recommends an AEL for the workplace for R-531A of 653 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Commercial ice machines (<i>new and retrofit equipment</i>).	R-449A (Opteon® XP 40)	Acceptable	<p>R-449A has a 100-year GWP of approximately 1,400. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449A of 830 ppm (8-hr TWA).</p>
Refrigerated transport (<i>new and retrofit equipment</i>).	R-449A (Opteon® XP 40)	Acceptable	<p>R-449A has a 100-year GWP of approximately 1,400. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449A of 830 ppm (8-hr TWA).</p>

End-Use	Substitute	Decision	Further Information ¹
Retail food refrigeration (<i>new and retrofit supermarket systems remote condensing units, and new and retrofit low-temperature² stand-alone equipment only</i>)	R-449A (Opteon® XP 40)	Acceptable	<p>R-449A has a 100-year GWP of approximately 1,400. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449A of 830 ppm (8-hr TWA).</p>
Non-mechanical heat transfer (<i>new and retrofit equipment</i>).	Methoxytridecafluoroheptene isomers (MPHE; Sinera™)	Acceptable	<p>MPHE has a 100-year GWP of approximately 2.5. MPHE is a mixture of structural and stereo isomers, which includes <i>trans</i>-5-methoxy-perfluoro-3-heptene and eight isomeric structures.</p> <p>This blend is nonflammable.</p> <p>The manufacturer recommends an AEL of 500 ppm (8-hr TWA) for MPHE.</p>

¹ Observe recommendations in the manufacturer's SDS and guidance for all listed refrigerants.

² "Low-temperature" refers to equipment that maintains food or beverages at temperatures at or below 32°F (0 °C). See appendix U to 40 CFR part 82, subpart G.

³ "Medium-temperature" refers to equipment that maintains food or beverages at temperatures above 32°F (0 °C). See appendix U to 40 CFR part 82, subpart G.

Foam Blowing

End-use	Substitute	Decision	Further Information ¹
Rigid polyurethane spray foam (<i>high-pressure, two-part uses only</i>).	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene; <i>cis</i> -1,1,1,4,4,4,-hexafluorobut-2-ene; FEA-1100; Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ozone depletion potential (ODP) and a 100-year GWP of roughly nine.</p> <p>This compound is nonflammable.</p> <p>The WEEL committee of the Occupational Alliance for Risk Science recommends a WEEL for the workplace of 500 ppm on an 8-hour TWA for HFO-1336mzz(Z).</p>

¹ Observe recommendations in the manufacturer's SDS and guidance for the listed substitute.

Solvent Cleaning

End-use	Substitute	Decision	Further Information ¹
Electronics cleaning, metals cleaning, precision cleaning	Methoxytridecafluoroheptene isomers (MPHE; Sion™)	Acceptable	<p>MPHE has a 100-year GWP of approximately 2.5. MPHE is a mixture of structural and stereo isomers, which includes <i>trans</i>-5-methoxy-perfluoro-3-heptene and eight isomeric structures.</p> <p>This blend is nonflammable.</p> <p>The manufacturer recommends an AEL of 500 ppm (8-hr TWA) for MPHE.</p>

¹ Observe recommendations in the manufacturer's SDS and guidance for the listed substitute.

Aerosols

End-use	Substitute	Decision	Further Information ¹
Solvent	Methoxytridecafluoroheptene isomers (MPHE)	Acceptable	<p>MPHE has a 100-year GWP of approximately 2.5. MPHE is a mixture of structural and stereo isomers, which includes <i>trans</i>-5-methoxy-perfluoro-3-heptene and eight isomeric structures.</p> <p>This blend is nonflammable.</p> <p>The manufacturer recommends an AEL of 500 ppm (8-hr TWA) for MPHE.</p>

¹ Observe recommendations in the manufacturer's SDS and guidance for the listed substitute.

Adhesives, Coatings, and Inks

End-use	Substitute	Decision	Further Information ¹
Adhesives, coatings	Methoxytridecafluoroheptene isomers (MPHE; Suprion™)	Acceptable	<p>MPHE has a 100-year GWP of approximately 2.5. MPHE is a mixture of structural and stereo isomers, which includes <i>trans</i>-5-methoxy-perfluoro-3-heptene and eight isomeric structures.</p> <p>This blend is nonflammable.</p> <p>The manufacturer recommends an AEL of 500 ppm (8-hr TWA) for MPHE.</p>

¹ Observe recommendations in the manufacturer's SDS and guidance for the listed substitute.

[FR Doc. 2015-17469 Filed: 7/15/2015 08:45 am; Publication Date: 7/16/2015]